CLAIMS

What is claimed is:

1. A method for making a two-phase polymeric material, comprising the steps of:

immobilizing a lyotropic liquid crystal by treatment with a polyion-type compound, wherein the lyotropic liquid crystal comprises a solution of supramolecules in a solvent, the supramolecules comprise molecules of a modified organic substance, the molecules each have one or more modifying functional groups, and the polyion-type compound is capable of forming counterions for the modifying functional groups;

exerting an external orienting force to order the immobilized lyotropic liquid crystal;

substantially removing the solvent to form a first phase that comprises a film of the ordered, immobilized organic molecules; and

forming a second phase that comprises a polymeric matrix by treating the film with a binding agent.

2. The method of Claim 1, wherein the lyotropic liquid crystal is formed by concentrating a solution of supramolecules.

3. The method of Claim 1 wherein the organic molecules are discotic molecules of the modified organic compound.

4. The method of Claim 1, wherein the concentration of the lyotropic liquid crystal in the solution is in the range of approximately 3% to 50% by mass.

5. The method of Claim 1, wherein the concentration of the lyotropic liquid crystal in the solution is in the range of approximately 7% to 15% by mass.

6. The method of Claim 1, wherein the solvent is water.

7. The method of Claim 1, wherein the solvent comprises water and an organic solvent that is miscible with water.

8. The method of Claim 1, wherein the steps of the external orienting action and the solvent removal take place simultaneously.

9. The method of Claim 1, wherein the modified organic substance has the general formula

$$\{R\}(F)_n,$$

where R is a polycyclic organic compound with conjugated π bonds, F is a modifying functional group, and n is the number of modifying functional groups.

10. The method of Claim 9, wherein the modifying functional groups are ionogenic, and wherein the ionogenic groups have associated therewith one or more counterions.

11. The method of Claim 9, wherein the modifying functional groups are nonionogenic.

12. The method of Claim 1, wherein the lyotropic liquid crystal further comprises a surfactant or a mixture of surfactants with a concentration of less than approximately 5% by mass.

13. The method of Claim 1, wherein the lyotropic liquid crystal further comprises a plasticizer or a mixture of plasticizers with a concentration of less than approximately 5% by mass.

14. The method of Claim 1, wherein the polyion compound is selected from oligomers, polymers, and their blends, and wherein the interaction of the polyion compound with the ionogenic groups does not disturb the lyotropic liquid crystal.

15. The method of Claim 1, wherein the external orienting force comprises one or several external actions selected from the list consisting of an electric field, a magnetic field, and mechanical shear.

16. The method of Claim 1, wherein the solvent is removed at a temperature in the range of approximately 20 to 60 °C and at a relative humidity greater than approximately 60%.

17. The method of Claim 16, wherein the solvent is removed at a temperature of approximately 20 °C for less than approximately 3 hours.

18. The method of Claim 1, wherein the formation of the second phase further comprises interaction of the reactive groups of the film of the ordered, immobilized organic molecules with molecules of the binding agent.

19. The method of Claim 1, wherein the binding agent comprises an organic molecule selected from the class of organic substances containing nucleophilic reactive groups.

20. The method of Claim 19, wherein the polymer matrix is formed by a condensation mechanism.

21. The method of Claim 20, wherein the polymer matrix formation is initiated by chemical interaction.

22. The method of Claim 1, wherein the binding agent comprises an organic molecule selected from the class of organic substances containing an electrophilic reactive group.

23. The method of Claim 22, wherein the polymer matrix is formed by an ion mechanism.

24. The method of Claim 23, wherein the polymer matrix formation is initiated by chemical interaction.

25. The method of Claim 1, wherein the binding agent comprises a saturated or unsaturated compound.

26. The method of Claim 25, wherein the polymer matrix is formed by a radical mechanism.

27. The method of Claim 26, wherein the polymer matrix formation is initiated by thermal reaction or chemical interaction.

28. The method of Claim 26, wherein the polymer matrix formation is initiated by UV radiation.

29. The method of Claim 28, wherein the binding agent further comprises a photosensitizer with a concentration less than approximately 0.5% by mass.

30. The method of Claim 29, wherein the polymer matrix formation is initiated by UV radiation.

31. The method of Claim 1, wherein the polymer matrix is formed by a combined mechanism.

32. The method of Claim 31, wherein the binding agent further comprises a photosensitizer with a concentration less than approximately 0.5% by mass.

33. The method of Claim 1, wherein the binding agent comprises a solution of at least one polymer that does not disturb the film of the ordered immobilized system of organic molecules.

34. The method of Claim 33, wherein the binding agent further comprises a photosensitizer with a concentration less than approximately 0.5% by mass.

35. The method of Claim 1, wherein the binding agent comprises a melt of at least one polymer that does not disturb the film of the ordered immobilized system of organic molecules.

36. The method of Claim 35, wherein the binding agent further comprises a photosensitizer with a concentration less than approximately 0.5% by mass.

37. The method of Claim 1, further comprising the step of:

drying the polymer matrix at a temperature greater than approximately 100 °C for less than approximately 10 hours.

38. A two-phase polymeric material, comprising:

a first phase comprising a partially crystalline film that comprises ordered, immobilized, organic molecules wherein the molecules contain at least one modifying functional group; and

a second phase comprising a polymer matrix.

39. The two-phase polymeric material formed by the method of Claim 1.

40. The two-phase polymeric material of Claim 38, wherein the modifying functional groups are ionogenic.

41. The two-phase polymeric material of Claim 38, wherein the modifying functional groups are nonionogenic.

42. The two-phase polymeric material of Claim 38, further characterized in that the material is anisotropic and has a crystalline structure having an interplanar spacing in the range of approximately 3.4±0.3 Å along one of the optical axes of the crystalline structure.

43. The two-phase polymeric material of Claim 38, wherein the first phase comprises less than approximately 35% by mass of the material.

44. The two-phase polymeric material of Claim 38, wherein the polymer matrix is formed from aromatic monomers and has a degree of polymerization greater than approximately 40.

45. The two-phase polymeric material of Claim 38, wherein the polymer matrix is formed from aliphatic monomers and has a degree of polymerization greater than approximately 120.

46. The two-phase polymeric material of Claim 38, wherein the polymer matrix has a molecular weight in the range of approximately 4000 to 20000.

47. The two-phase polymeric material of Claim 38, wherein the polymer matrix has a molecular weight in the range of approximately 5000 to 8000.

48. The two-phase polymeric material of Claim 38, wherein the polymer matrix further comprises plasticizers at a concentration of less than approximately 5% by mass.

49. An optically anisotropic film comprising a layer of the two-phase polymeric material of Claim 38.

50. The film of Claim 49, wherein the film is polarizing.

51. The film of Claim 49, wherein the film is a retarder.

52. The film of Claim 49, wherein the film further comprises additional isotropic and/or anisotropic layers.